FARM FACTS

Produced by Saskatchewan Agriculture and Food

Fusarium Head Blight

Fusarium head blight (FHB), also known as scab, is a disease affecting the heads of wheat, barley, oats, rye, corn, triticale, canary seed and some forage grasses. FHB is caused by several species of the fungal pathogen, *Fusarium*. The most important species is *Fusarium graminearum*, since it can result in the most yield loss and is responsible for the production of toxin in the grain.

It is important that producers become more familiar with this potentially damaging disease and incorporate management practices to reduce spread and development in their crops.

Cereal head infection by fungal spores is favoured by moist, warm conditions during flowering. Symptoms may occur on the entire head or on just a few spikelets and can result in the formation of Fusarium damaged kernels (FDK). FDK are typically shriveled, light in weight, and white or pink in colour. It is because of these attributes they are named "tombstone kernels". FHB results in loss of yield and reduction in quality resulting in downgrading.

Why is Fusarium Head Blight a Concern?

FHB causes reduction in yield due to shrunken, lightweight kernels that are lost during combining or seed cleaning. More importantly, grade losses occur when the percentage of FDK in a sample exceeds grading tolerances.

The Canadian Grain Commission allows only very low levels of FDK in food and feed grains and zero levels in malting barley. The tolerances were set to account for the presence of potentially harmful fungal toxins, called mycotoxins, that are produced in diseased grain.

The most common mycotoxin found in grain affected by FHB is deoxynivalenol or DON. DON can reduce the feed intake by livestock and adversely affect the baking quality of wheat and the malting and brewing qualities of malt barley. Infected seed may also have reduced levels of germination and seedling vigour.

Where is Fusarium Head Blight a Problem?

In Manitoba, FHB has been prevalent since the mid-1980's but became a major concern in 1993 when severe yield and quality losses occurred. In Saskatchewan, *Fusarium graminearum* was first detected in samples from a few wheat fields grown near the Manitoba border in 1993.

Field surveys in Saskatchewan reveal that FHB has been slowly increasing in prevalence and is now considered established in the southeastern region of the province. FHB has also been found in other regions of the province but the causal species is not predominately *F. graminearum*.

There is evidence that the more aggressive *F. graminearum* is moving westward through the prairie provinces. Soil characteristics and precipitation patterns in the black and dark brown soil zones appear to favour FHB development.

Disease surveys are being conducted in Saskatchewan to determine where FHB is a

problem and to monitor its spread. Although this disease is not expected to increase to epidemic proportions in Saskatchewan, cereal producers need to be aware of its impending spread and the potential loss to quality and yield. Effective control of the spread of FHB is possible if management strategies are implemented and care is taken to use good quality seed, especially in areas considered free of FHB.

Disease Cycle and Conditions Required for Infection

Fusarium fungi can over-winter as spores or mycelium on seed and crop residue. Seed infected with the *Fusarium* fungi may be infected upon emergence, resulting in seedling blight. Some *Fusarium* species can also survive on roots of other crops, including pulses and oilseeds.

Studies have shown that many of the *Fusarium* fungi found in kernels from diseased heads of wheat and barley were also found in the subcrown internodes of cereal plants collected from the same field. This suggests that disease inoculum on crop residue may serve as a source for head infections later in the season.

Development of *Fusarium* spores is favoured by warm and moist conditions. Spores are spread by rain-splash and wind and can come in contact with above ground parts of cereals. FHB infection is most likely to occur during July when the florets are open during flowering, allowing the spore to come in contact with the floret. The FHB fungus can also enter through wounds caused by hail, birds or insects.

Precipitation or high humidity for at least 12 hours is required for spore germination and infection. Temperatures favouring infection range from 16 to 30°C, with the optimum range being 25 to 28°C. If conditions remain warm and moist, the pathogen may continue to sporulate and spread to other kernels or heads.

Cereals are most susceptible to infection by *Fusarium* spores at flowering, but infections may also occur on mature heads later in the growing season.

Fusarium graminearum has the ability to form a sexual spore stage on over-wintering cereal residue. New fungal strains with increased pathogenicity may develop as a result of the sexual reproductive cycle. In addition, the sexual spores can become air-borne and disperse with the wind over greater distances compared to those spores produced during the season.

Symptoms in the Field

Symptoms in the field usually become apparent by the end of July or early August. FHB is recognized as premature bleaching of one or more of the spikelets on the head. This symptom is quite striking on green heads.

Symptoms first begin as water-soaked brownish spots at the base of the glumes and ultimately glumes become bleached in colour. If humid conditions prevail, masses of white, pink or orange spores may form along the base of the glumes or over the infected head.

FHB symptoms can develop within three days of infection if conditions remain moist and warm. Heads infected at or shortly after flowering will display the greatest damage, although infection can still occur on the mature head if conditions favour sporulation.

Symptoms in Harvested Grain

Severity of damage to the kernel is dependent on the time of infection. Early infection will likely result in kernel loss, whereas, later infections may not exhibit symptoms but are still capable of harbouring the fungus. FDK in wheat are the most obvious, whereas, those in barley and oats are often more difficult to detect.

In wheat, rye and triticale, severe FDK are typically shrunken and chalky white. However, in hulled barley and oats, symptoms are less apparent since the kernels may not be shrunken, but orange or black fungal growth may develop on the hull. In hulless barley, both types of symptoms can occur.

If FDK are suspected, it is recommended to have seed tested for *F. graminearum* before planting or tested for levels of DON before feeding to livestock.

Mycotoxins

Deoxynivalenol or DON is the most common mycotoxin associated with FHB in Canada and is produced in high amounts by *F. graminearum*. Compared to other mycotoxins, DON is one of the least toxic but it may result in reduced feed consumption or feed refusal, especially when fed to non-ruminants.

DON levels in a sample are influenced by many factors, but most important are the percentage of FDK and the causal species.

Livestock vary in their tolerance to DON so it is important to have infected feed grain tested for levels of DON. There is zero tolerance for levels of DON in malting barley. Producers should consult their nearest grain company and ask for the latest Canadian Grain Commission's grading tolerances and for laboratories capable of testing for DON.

Management Strategies for Fusarium Head Blight

An integrated approach to managing FHB is needed for controlling the spread and development of FHB. It is important to slow the movement of FHB by avoiding the introduction of *F. graminearum* through infected seed to non-infected areas.

Producers should practice scouting their fields for FHB symptoms during kernel development or for the presence of FDK in harvested grain.

Seed Quality: Plant clean seed. In areas where *F. graminearum* is rare or absent, the use of clean seed or seed treatments may delay its introduction and reduce future losses from FHB. However, the role *F. graminearum* infected seed plays in the spread of the disease is still unclear. Avoid purchasing FHB infected seed to plant in areas of the province where *F. graminearum* is not present.

Studies have shown that FDK have decreased seedling emergence and tillering. Seed should be tested for the presence of *F. graminearum* if there are concerns about quality.

Seed Treatment: The use of seed treatments will limit seedling blights caused by seed and soil-borne pathogens, including *Fusarium* species. Seed treatments will not prevent FHB from developing later in the season from stubble-borne disease inoculum in regions where *Fusarium* species are already established.

Crop Rotation: Practice a rotation away from cereal crops for at least one year, preferably two years. Avoid seeding cereals into wheat or barley stubble and avoid planting adjacent to fields which had known levels of FHB in the previous year.

For those producers considering growing corn, be aware that corn in rotation with small cereal grains has been shown to increase FHB. Control grassy weeds which may harbour disease between cereal crops.

Stubble Management: Cereal residue will enable the fungus to over-winter and act as a source of disease inoculum for the following year. Effective chopping and spreading of straw and spreading of chaff will encourage decomposition of the residue. Burying the residue through tillage will also speed up its decomposition but may not completely eliminate the risk since all residue is not buried or may be brought to the surface again in subsequent tillage operations.

Variety Selection: There are currently no varieties with resistance to FHB; however, cereals vary in their susceptibility to FHB.

Within each cereal class there are some varieties which have more tolerance to FHB. Breeding programs are in place to develop varieties with improved resistance to FHB. Refer to the Varieties of Grain Crops in the Saskatchewan Seed Guide for a list of the more tolerant varieties.

Most Susceptible ⟶ *Least Susceptible*

Durum
Winter wheat > CPS > HRS > Barley 6 row > Barley 2 row > Oats
Triticale
Extra strong

Harvest Management:
When harvesting cereals, adjust combine air velocities and openings to blow out lightweight kernels. If this practice is done, do not plant a cereal crop for two years in that field as *F. graminearum* has been found to survive on seed overwintering in the soil.

Cleaning the grain after harvest to remove shrunken lightweight kernels may also reduce grade losses and DON concentration. However, even after cleaning out the severely infected kernels, there may still be some DON present in the grain. Prevent additional grading losses from occurring in the bin by storing at less than 14% grain moisture content. Grain with known levels of FDK should be stored in a separate bin.

Foliar Fungicides: Research is on-going to develop effective fungicides and improve sprayer technology for the control of FHB. At this time, fungicide application has not been proven to be a consistently reliable or economical practice for controlling FHB. This is because success of a foliar application depends on a number of factors including active ingredient, rate, timing and frequency of application, weather conditions, sprayer technology and variety susceptibility to FHB. Refer to the Guide to Crop Protection for current information on the fungicides registered for FHB.

Are You At Risk From Fusarium Head Blight?
(Adopted from Cereal Research Centre, AAFC, Winnipeg)

Greater Risk - *The more points in this column that apply, the greater the risk.*	**Lesser Risk** - *The more points in this column that apply, the lesser the risk*
___ You know you have had FHB in your fields or you farm in areas where FHB has been a problem.	___ You have not observed shrunken chalky kernels in your seed or FHB has not been a problem in your area.
___ You grow wheat and barley every year on your farm.	___ You rotate between cereal and pulse, oilseed or other broadleaf crops.
___ You grow durum, extra strong, winter or CPS wheat. You grow the less tolerant varieties of HRS wheat and barley.	___ You grow HRS wheat, barley or oats. You grow the least susceptible varieties of HRS wheat and barley.
___ You seed only one cereal variety over a short timeframe each year.	___ You seed two or more varieties of different maturities; or, the same variety but over a two to four week period.
___ You practice minimum or zero tillage.	___ You practice conventional tillage.
___ Your soil is a heavy clay and drains slowly.	___ Your soil is a lighter clay loam, loam or sandy loam and drains readily.
___ The growing season has been wetter than normal, particularly at the heading/flowering stage, with prolonged periods of high humidity.	___ The growing season has been drier than normal, or you had no rain during the heading/flowering period.

For more formation, contact the nearest Saskatchewan Agriculture & Food Rural Service Centre.

Additional Resources:
Pictures and descriptions of Fusarium head blight are available on the following web pages:

- Saskatchewan Agriculture and Food: **www.agr.gov.sk.ca/**
- Canadian Grain Commission: **www.cgc.ca/Pubs/fusarium/fusariume2.htm**
- Manitoba Agriculture: **www.gov.mb.ca/agriculture/crops/diseases/fac12s01.html**
- North Dakota State University: **www.ext.nodak.edu/extpubs/plantsci/smgrains/pp804w.htm**

Saskatchewan Agriculture and Food

Printed January 2000
10M ISSN 0840-9447 SUS 0100